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VERIFICATION OF TRANSLATION

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

Miyoko YANAGIDA residing at 1-13-7-302, Yamamoto-maruhashi, Takarazuka, Hyogo, Japan declares:

(1) that she knows well both the Japanese and English languages;

(2) that she translated Japanese patent application No. JP2002-261590 from Japanese to English;

(3) that the attached English translation is a true and correct translation of Japanese patent application No. JP2002-261590 to the best of her knowledge and belief; and

(4) that all statements made of her own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and that such false statements may jeopardize the validity of the application or any patent thereon.

This 8th day of January, 2009

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[Title of the Invention] COMMUNICATION SYSTEM

[Claims]

[Claim 1]

A communication system comprising:

a router connected to an internet network;

a local network connected to said router;

an internet terminal communicatively connected to said router via said local network and holding a private address; and

an internet server connected to the internet network,

wherein said router (i) holds a single global address, (ii) receives, from said local network, a local packet to be sent to the internet network, (iii) generates a global packet by converting the private address included in a sender's address into the global address and converting a local port number included in a sender's port number into a global port number, (iv) generates table information including correspondence between the converted private address and the local port number, and the global address and the global port number and stores the table information for a specified period of time, (v) sends the global packet to the internet network, (vi) receives a response global packet that is a response to the global packet from the internet network, (vii) converts, with reference to the table information, the received response global packet into a response local packet that is a response to the local packet and (viii) sends the converted response local packet to said local network,

said internet terminal includes:

a polling unit operable to repeatedly send the local packet to said router, the local packet including the private address as a sender's address, the local port number as a sender's port number, an address of said internet server as a destination address, and a terminal ID for identifying said internet terminal; and

a control unit operable to receive the response local packet from said router, and perform a predetermined operation, and

said internet server includes:

a terminal information storage unit operable to receive the global packet from said router, and store the following information included in the global packet as a set of terminal information: (i) the terminal ID; (ii) the global address which is a sender's address; and (iii) the global port number which is a sender's port number, and

a control request unit operable (i) to extract, from the terminal information, the global address and the global port number which correspond to the terminal ID, when a control request to control said internet terminal with the terminal ID occurs, (ii) to incorporate a control command in accordance with the control request into a data, and (iii) to send a control request to said router as the response global packet, the control request including the extracted global address and the global port number as a destination address and a destination port number, respectively.

[Claim 2]

The communication system according to Claim 1,

wherein a plurality of appliances are connected to said internet terminal via a home network,

each of the appliances includes an appliance control unit,

said control unit makes an appliance control request to the appliance control unit according to the control command included in the response local packet, and

the appliance control unit controls the each of the appliances.

[Claim 3]

The communication system according to Claim 1 or 2,

wherein the appliance control unit sends, to said internet terminal, result data including a control result of the appliance, and

said control unit of said internet terminal (i) receives the result data, (ii) incorporates the control result included in the result data into a control result local packet that is a packet for sending the control result, and (iii) sends the control result local packet to said router.

[Claim 4]

The communication system according to any one of Claim 1 to Claim 3,

wherein a mobile terminal is connected to the internet network,

the mobile terminal sends, to said internet server, a control command sending request to be sent to said internet terminal with the specific terminal ID, and

said control request unit generates the response global packet according to the control command sending request.

[Claim 5]

The communication system according to any one of Claim 1 to Claim 4,

wherein said control request unit of said internet server receives a control result global packet to which said router converted the control result local packet, and sends the control result included in the control result global packet to the mobile terminal.

[Claim 6]

The communication system according to Claim 1,

wherein said polling unit of said internet terminal incorporates, into the local packet, a polling interval that is an interval at which the local packet is sent, and sends the local packet to said router,

said internet server further includes a response interval adjustment unit operable (i) to receive the global packet, (ii) to obtain the polling interval included in the global packet, and (iii) to

determine, from the polling interval, a response sending period during which the response global packet should be sent to said router, and

said control request unit sends the response global packet to said router, even when there is no control request during the response sending period.

[Claim 7]

The communication system according to Claim 1 or Claim 6,

wherein said internet terminal further includes said control request unit which shortens the polling interval when said internet terminal has not received the response local packet from said router within a specified time.

[Claim 8]

The communication system according to Claim 1,

wherein said internet terminal stores a password used for performing authentication on the terminal ID,

said internet server stores an authentication terminal ID and an authentication password, the authentication terminal ID containing information which is the same as the terminal ID, and the authentication password containing information which is the same as the password,

said polling unit of said internet terminal (i) obtains a digest value by inputting, into a predetermined function, the terminal ID, the password and a random number, (ii) incorporates the terminal ID, the random number, and the digest value into the local packet, and (iii) sends the local packet to said router, and

said terminal information storage unit of said internet server (i) receives the global packet, (ii) obtains an authentication digest value by inputting, into the predetermined function, the authentication terminal ID, the authentication password, and the random number included in the global packet, and (iii) performs authentication on said internet terminal by comparing the

authentication digest value with the digest value included in the global packet.

[Claim 9]

The communication system according to Claim 1 or 8,

wherein said internet terminal includes an encryption processing unit operable to encrypt the local packet.

[Claim 10]

The communication system according to Claim 1,

wherein said polling unit makes the local port number a random number.

[Claim 11]

The communication system according to Claim 1 or 10,

wherein said polling unit of said internet terminal (i) obtains the digest value by inputting, into the predetermined function, the terminal ID, the password, the local port number and the random number, (ii) incorporates the terminal ID, the random number, the digest value and the local port number into the local packet, and (iii) sends the local packet to said router, and

said terminal information storage unit of said internet server (i) receives the global packet, (ii) obtains an authentication digest value by inputting, into the predetermined function, the authentication terminal ID and the authentication password, and the local port number and the random number included in the global packet, and (iii) performs authentication on said internet terminal by comparing the authentication digest value with the digest value included in the global packet.

[Claim 12]

The communication system according to any one of Claim 1, 10 and 11,

wherein said control request unit of said internet server (i) incorporates the terminal ID and the local port number included in

the global packet into the response global packet, and (ii) sends the response global packet to said router, and

said polling unit (i) receives the response local packet, (ii) obtains the terminal ID and the local port number included in the response local packet, and (iii) performs authentication on the response local packet by comparing the obtained terminal ID and the local port number with the local port number included in the local packet.

[Claim 13]

The communication system according to any one of Claim 1 to Claim 3,

wherein a portal server is connected to the internet network,

the portal server sends, to said internet server, a portal server connection request to be sent to said internet terminal with the specific terminal ID,

said control request unit of said internet server generates the response global packet that includes an address of the portal server according to the portal server connection request, and

said control unit of said internet terminal (i) receives the response local packet from said router, and (ii) sends, to said router, the control result local packet having the address of the portal server included in the response local packet as a destination address.

[Claim 14]

The communication system according to any one of Claims 1 to 3, and 13,

wherein the mobile terminal sends, to the portal server, the control command sending request to be sent to said internet terminal with the specific terminal ID, and

the portal server receives the control command sending request, and send the portal server connection request to said internet server.

[Claim 15]

The communication system according to any one of Claims 1 to 3, 13 and 14,

wherein the portal server receives the control result global packet to which said router converts the control result local packet, and sends the control result included in the control result global packet to the mobile terminal.

[Detailed Description of Invention]

[0001]

[Technical Field]

The present invention relates to a communication system using the Internet, and particularly to a polling method performed by an internet terminal which is connected to an internet communication network at all times.

[0002]

[Related Art]

In order to ensure a communication line between an internet terminal and an internet server via an internet network in homes at all times, such a conventional method is used that: (i) a plurality of internet terminals assigned with private addresses are connected to a router that is connected to the communication line; (ii) the router is connected to the internet network via an internet service provider using the communication line; and (iii) the internet service provider assigns a global address to the router.

[0003]

When the internet server makes a control request to an internet terminal in the above method, the following conventional methods are used: a router is set to perform static IP masquerading (e.g. patent document 1); and an internet terminal performs polling (e.g. patent document 2).

[0004]

In static IP masquerading, a router, when receiving packet in which a specific port number is described as a destination port number, converts the destination address into the private address of an internet terminal, and then sends the packet to the internet terminal.

[0005]

In the method in which an internet terminal performs polling, on the other hand, a router receives, from an internet terminal, a local

packet to be sent to the internet server and sends such packet to the internet server after converting the sender's address included in the packet into the global address of the router; converting the sender's port number included in the packet into a port number which can be used by the router; and storing for a specified period of time, a set of information including the private address of the internet terminal, the global address of the router, the sender's port number of the internet terminal, and the sender's port number of the router. The router receives, from the internet server, a response global packet that includes the details of a control intended for the internet terminal, and sends such packet to the internet terminal after converting the destination address and the destination port number that are included in the response global packet into the private address and the destination port number of the internet terminal, respectively, with reference to the set of information, stored in the router, including the private address of the internet terminal, the global address of the router, the sender's port number of the internet terminal, and the sender's port number of the router.

[0006]

[Patent reference 1]

Japanese Unexamined Patent Application Publication No. 2000-341337

[Patent reference 2]

Japanese Unexamined Patent Application Publication No. 08-204704

[0007]

[Problems that Invention is to Solve]

However, the use of the static IP masquerade method for the router described above requires a user to make a setting for the router. Moreover, since a specific port number should be disclosed on an internet network, there are potential risks associated with security such as intrusion. Meanwhile, when a local packet is sent from an internet terminal to the internet server using a simple polling

method, the immediacy is lost because of the fact that there is a polling interval. Also, another problem has existed that an internet terminal fails to receive a response global packet depending on the type of a router or an internet connection environment.

[0008]

The present invention is intended to solve the above problems, and provides a communication system in which the internet server performs, at an arbitrary timing, an immediate control on internet terminals assigned with private addresses by the router.

[0009]

[Means to Solve the Problems]

The communication system according to the present invention allows an internet terminal to be controlled by the following procedures: the internet terminal periodically sends, to a router, a local packet to be sent to an internet server; the internet server (i) receives a global packet in which the sender's address and the sender's port number included in the local packet are converted by the router, (ii) stores, as terminal information, a set of information including the terminal ID, the sender's address and the sender's port number that are included in the global packet, (iii) when a control request to control the internet terminal occurs, extracts, from the terminal information, the sender's address and the sender's port number of the terminal ID to be controlled, (iv) incorporates the extracted information into the destination address and the destination port number of the response global packet and sends it to the internet terminal; and the internet terminal receives the response local packet in which the destination address and the destination port number included in the response global packet are converted by the router.

[0010]

[Embodiments of the Present Invention]

Embodiments of the present invention will be described with

reference to the drawings.

[0011]

(First Embodiment)

FIG. 1 is a diagram showing a communication system according to an embodiment of the present invention. In FIG. 1, the communication system according to the present embodiment is composed of an internet server 1, an internet network 2, a communication line 3, a router 4, a private network 5 and an internet terminal 6.

[0012]

The internet server 1 includes a terminal information storage unit 10, a response interval adjustment unit 11, an encryption processing unit 12, a control request unit 13, and a communication unit 14. The internet terminal 6 includes a communication unit 60, a polling unit 61, an encryption processing unit 62, a control unit 63 and a polling interval adjustment unit 64.

[0013]

The terminal information storage unit 10 holds, as terminal information, a set of information including the terminal ID, the sender's address and the sender's port number that are included in the global packet sent from the router 4. The response interval adjustment unit 11 determines an interval at which a response global packet should be sent based on the polling interval included in the global packet sent by the router 4. The encryption processing unit 12 decrypts the received packet and encrypts a packet to be sent out. The control request unit 13 generates a response global packet to the global packet. The communication unit 14 performs communication with the router 4 via the internet network 2.

[0014]

The communication unit 60 performs communication with the router 4 via the private network 5. The polling unit 61 holds the terminal ID and the password for identifying the internet terminal 6, and

generates a local packet. The encryption processing unit 62 encrypts a packet to be sent out and decrypts a received packet. The control unit 63 receives, from the router 4, the response local packet including a control command, and controls the internet terminal 6 according to the control command included in the response local packet. The polling interval adjustment unit 64 adjusts the interval at which a local packet shall be sent out periodically.

[0015]

Here, the global packet refers to a packet sent from the router 4 to the internet server 1. The sender's address includes the global IP address of the router 4, and the destination address includes the global IP address of the internet server 1. The local packet refers to a packet sent from the internet terminal 6 to the router 4. The sender's address includes the local IP address of the internet terminal 6, and the destination address includes the global IP address of the internet server 1.

[0016]

Furthermore, the response global packet is sent from the internet server 1 to the router 4, and the response local packet is sent from the router 4 to the internet terminal 6.

[0017]

FIG. 2 is a flow chart showing that the internet terminal 6 sends a local packet (to be referred to as "packet 1" hereinafter) to the router 4 periodically.

[0018]

The polling unit 61 generates a frame (to be referred to as "frame 1" hereinafter) for sending a local packet, and passes the generated frame 1 to the encryption processing unit 62. FIG. 3(a) shows an example of the frame 1. A terminal ID 100 includes a terminal ID for identifying the internet terminal 6; a random value 101 includes a random number, a digest value 102 includes a value outputted by

inputting the terminal ID 100, a local port number 103, the password, and the random value 101 into a specified function; the local port number 103 includes a port number which the internet terminal 6 can use; and a polling interval 104 includes an interval at which a local packet is sent periodically (to be referred to as "polling interval 1" hereinafter). As the above specified function, MD5 which is a hush function can be used, for example. The encryption processing unit 62 encrypts the frame 1, and passes the resultant to the communication unit 60 (S1000). DES and the like is an example encryption method here. The communication unit 60 adds a header to the frame 1 which is the data part to generate the packet 1, and sends the generated packet 1 to the router 4 (S1001). FIG. 3(b) shows an example of the packet 1.

[0019]

The destination address 110 includes the address of the internet server 1; the destination port number 111 includes a port number which the internet server 1 can use; the sender's address 112 includes the address of the internet terminal 6; the sender's port number 113 includes a port number which is equivalent to the local port number 103; and the data part 114 includes the encrypted frame 1. After sending the packet 1, the internet terminal 6 performs processing for receiving the response global packet (S1002), and then returns to S1000 for sending the packet 1 to the router 4 repeatedly. A detailed explanation of this receiving process is given later.

[0020]

An explanation is given of the processing performed by the router 4 when receiving the packet 1 from the internet terminal 6 and converting it into a global packet (to be referred to as "packet 2" hereinafter) so as to send the resultant to the internet server 1. When receiving the packet 1, the router 4 generates the packet 2 by converting the sender's address 112 included in the packet 1 into

the global address of the router 4 and by converting the sender's port number 113 into a port number which can be received by the router 4. Then the router 4 stores, as table information, a set of the private address and the sender's port number of the internet terminal 6 and the global address and the sender's port number of the router, and send the packet 2 to the internet terminal 1. FIG. 4 shows an example of the table information.

[0021]

An address 200 of the internet terminal 6 includes the private address of the internet terminal 6 that is the sender's address 112 of the packet 1, and a port number 201 includes the sender's port number 113 of the packet 1. An address 202 of the router 4 includes the global address of the router 4 that is the sender's address of the packet 2, and a port number 203 includes the sender's port number of the packet 2.

[0022]

FIG.5 is a flowchart showing the procedure followed by the internet server 1 when receiving the packet 2 and sending a response global packet (to be referred to as "packet 3" hereinafter) to the router 4 in response to the packet 2.

[0023]

The communication unit 14 receives the packet 2 and passes it to the encryption processing unit 12. The encryption processing unit 12 decrypts the data part 114 included in the packet 2, and passes the resultant to the terminal information storage unit 10 (S2000). Then, the terminal information storage unit 10 performs authentication by (i) obtaining the terminal ID 100, the random value 101, the digest value 102 and the local port number 103 that are included in the data part 114, (ii) searching for a password corresponding to the terminal ID 100, (iii) determining a value by inputting, into a function equivalent to the one used by the polling unit 61, the terminal ID 100, the local port number 103, the

password, and the random value 101, and (iv) comparing the determined value with the digest value 102 (S2001). When the authentication failed, the packet 2 is destroyed. When the authentication succeeded, the terminal information storage unit 10 obtains a set of information including the terminal ID 100, the sender's address 112, and the sender's port number 113 that are included in the packet 2, and stores the obtained set of information as terminal information (S2002). FIG. 6 shows an example of the terminal information.

[0024]

A terminal ID 300 includes the terminal ID 100 included in the data part 114 of the packet 2, an address 301 includes the sender's address 112, and a port number 302 includes the sender's port number 113. Furthermore, the terminal information storage unit 10 obtains the polling interval 104 included in the packet 2, and passes it to the response interval adjustment unit 11. From such polling interval 104, the response interval adjustment unit 11 determines an interval at which the packet 3, a response to the packet 2 (to be referred to as "response send interval" hereinafter), should be sent (S2003). The control request unit 13 detects whether or not a control request to control the internet terminal 6 has occurred during the above determined response send interval (S2004). When a control request occurs, the control request unit 13 stores the contents of the control request in a control request command to be incorporated into the packet 3 (S2005). Meanwhile, when no control request occurs during the response send interval, the control request unit 13 stores, in the control request command, data indicating that there is no control request (S2006), generates a frame (to be referred to as "frame 2" hereinafter) to be incorporated into the packet 3, and passes it to the encryption processing unit 11. FIG. 7(a) shows an example of the frame 2.

[0025]

A terminal ID 400 includes the terminal ID of the internet terminal 6 to be controlled, a port number 401 includes the local port number 103 included in the data part 114 of the packet 2, and a control request command 402 includes a control command requested to the internet terminal 6. The encryption processing unit 11 encrypts the frame 2 (S2007), and passes the resultant to the communication unit 14. The communication unit 14 extracts, from the terminal information, the terminal ID of the internet terminal 6 to be controlled, i.e. the terminal ID which matches the terminal ID 400 included in the frame 2, obtains the terminal ID 300, an address 301, and a port number 302, and then adds such obtained information to the header of the packet 3 so as to generate the packet 3. FIG. 7(b) shows an example of the packet 3.

[0026]

The destination address 410 includes the address 301 of the terminal information that is the global address of the router 4, the destination port number 411 includes the port number 302 of the terminal information, the sender's address 412 includes the address of the internet server 1, and the sender's port number 413 includes the port number which the internet server 1 can use. The communication unit 14 sends the packet 3 to the router 4 (S2008).

[0027]

An explanation is given of the procedure followed by the router 4 when receiving, form the internet server 1, the packet 3 as a response to the packet 2, converting it into a response local packet (to be referred to as "packet 4" hereinafter) as a response to the packet 1, and sending such response local packet to the internet terminal 6. The router 4 receives the packet 3, generates the packet 4 by converting the destination address 410 included in the packet 3 into the address 200 of the internet terminal 6 in the table information and converting the destination port number 411 into the port number of the internet terminal 6 in the table information 1,

and send the packet 4 to the internet terminal 6. The router 4 deletes a pair of the address 200 and the port number 201 of the internet terminal 6 and the address 202 and the port number 203 of the router 4 stored in the table information, when there was no packet1 or packet 3 received during a certain period of time. When the above pair does not already exist, the packet 3 shall be destroyed.

[0028]

FIG. 8 is a flow chart showing that the internet terminal 6 performs receiving process.

[0029]

After sending the packet 1, the communication unit 60 waits for receiving the packet 4 during the polling interval 1 (S4000). When receiving the packet 4 during the polling interval (S4001), the communication unit 60 passes the received packet 4 to the encryption processing unit 62. The encryption processing unit 62 decrypts the data part 414 of the packet 4, and passes the resultant to the control unit 63. The control unit 63 then performs authentication by making a judgment on whether the terminal ID 400 included in the data part 414 matches the terminal ID possessed by the internet terminal 6 and on whether the port number 401 matches the local port number 103 used when the frame 1 was generated (S4002). When the authentication failed, the communication unit 63 returns to the wait state for receiving the packet 4. When the authentication succeeded, the control unit 63 obtains the control request command 402 included in the data part 414. And, when the contents of the control request command 402 indicate "no control request" (S4003), the control unit 63 terminates the receiving process. When the contents of the control request command 402 indicate "there is a control request for controlling the internet terminal 6 (S4003), the control unit 63 controls the internet terminal 6 according to the contents of the

control request command 402 (S4004). When the communication unit 60 did not receive the packet 4 during the polling interval (S4001), the polling interval adjustment unit 64 shortens the polling interval 1. For example, when the polling interval 1 is set to 20 minutes as the default, such polling interval is made shorter minute by minute (e.g. 19 minutes, 18 minutes...) until the packet 4 is received. Assuming that the communication unit 63 receives the packet 4 when the polling interval 1 has been shortened to 10 minutes, the packet 1 is sent setting the polling interval 1 as 10 minutes from then on. Note that the polling interval 1 may be shortened to 10 minutes or shorter, e.g. 9.5 minutes in such a case.

[0030]

(Second embodiment)

An explanation is given of a second embodiment in which an appliance is set at home. Reference will be made to FIG. 9. FIG. 9 has an appliance 7 newly added to the configuration of FIG. 1. In FIG.9, the same constituent elements as those illustrated in FIG.1 are assigned with the same numbers, and detailed explanations thereof are omitted.

[0031]

The appliance 7 has an appliance control unit 70. The appliance 7 is connected to an internet terminal 6 via a home network 8. Examples of the home network include an electric wire and wireless.

[0032]

The appliance control unit 70 receives a control command from the internet terminal and controls the appliance 7.

[0033]

A control request unit 13 of an internet server 1 generates a frame 2 by incorporating a command and data used for controlling the appliance 7 into a control request command 402, and passes it to an encryption processing unit 12. In a manner equivalent to the first embodiment, the encryption processing unit 12 encrypts the frame

2, and a communication unit 14 generates a packet 3, and sends it to a router 4.

[0034]

In a manner equivalent to the first embodiment, a communication unit 60 of the internet terminal 6 receives a packet 4, and an encryption processing unit 62 decrypts a data part 414 of the packet 4 and passes the resultant to a control unit 63. The control unit 63 obtains the control request command 402 included in the data part 414 of the packet 4, and sends a control command to the appliance 7 via the home network, when such control command is intended for controlling the appliance 7.

[0035]

The appliance control unit 70 of the appliance 7 receives the control command, and controls the appliance 7 according to the contents of the control command.

[0036]

(Third embodiment)

An explanation is given of a third embodiment in which a mobile terminal connected to the internet network controls, via an internet server, an appliance connected to an internet terminal. Reference will be made to FIG. 10. FIG. 10 has a mobile terminal 9 newly added to the configuration of FIG. 9. In FIG.10, the same constituent elements as those illustrated in FIG.9 are assigned with the same numbers, and detailed explanations thereof are omitted.

[0037]

The mobile terminal 9 sends, to an internet server 1 via an internet network 2, a control command sending request to be send to the internet terminal 6 including a specific terminal ID.

[0038]

A control request unit 13 of the internet server 1 generates a control request command 402 included in a frame 2 according to the received control command sending request, generates the frame 2

and passes it to an encryption processing unit 12. In a manner equivalent to the first and second embodiments, the encryption processing unit 12 encrypts the frame 2, and a communication unit 14 generates a packet 3 and sends it to a router 4.

[0039]

In a manner equivalent to the first and second embodiments, a communication unit 60 of an internet terminal 6 receives a packet 4, and an encryption processing unit 62 decrypts a data part 414 of the packet 4 and passes the resultant to a control unit 63. The control unit 63 obtains the control request command 402 included in the data part 414 of the packet 4, and controls the internet terminal 6 or the appliance 7 according to the contents of the control of the control request command 402.

[0040]

An appliance control unit 70 of the appliance 7 sends data indicating the control result to the internet terminal 6.

[0041]

The control unit 63 of the internet terminal 6 passes, to the encryption processing unit 62, a frame (to be referred to as "frame 3" hereinafter) to be sent to the internet server 1 by incorporating, into a frame 3, the data sent by the appliance 7 indicating its control result of the internet terminal 6. The encryption processing unit 62 encrypts the frame 3, and passes the resultant to the communication processing unit 60. The communication unit 60 generates a packet (to be referred to as "frame 5" hereinafter) to be sent to the internet server 1, in a manner equivalent to the first embodiment, and sends it to the router 4.

[0042]

In a manner described in the first embodiment, the router 4 converts the received packet 5 into a packet (to be referred to as "packet 6" hereinafter) to be sent to the internet server 1, and sends the resultant to the internet server 1 via the internet network 2.

[0043]

In the internet server 1, the communication unit 14 receives the packet 6 and passes it to the encryption processing unit 12, which then decrypts the frame 3 and passes the resultant to the control request unit 13. Then, the control request unit 13 sends, to the mobile terminal 9, the data indicating the control result of either the appliance 7 or the internet terminal 6 included in the frame 3.

[0044]

(Fourth embodiment)

An explanation is given of a fourth embodiment in which a portal server connected to the internet network controls, via an internet server, an appliance connected to an internet terminal. Reference will be made to FIG. 11. FIG. 11 has a portal server 80 newly added to the configuration of FIG. 10. In FIG.11, the same constituent elements as those illustrated in FIG. 10 are assigned with the same numbers, and detailed explanations thereof are omitted.

[0045]

A mobile terminal 9 sends, to the portal server 80 via an internet network 2, a control command sending request to be sent to an internet terminal 6 including a specific terminal ID.

[0046]

A communication unit 81 of the portal server 80 receives the control command sending request from the mobile terminal 9, and sends such sending request received from the mobile terminal 9 to an internet server 1 via the internet network 2.

[0047]

A control request unit 13 of the internet server 1 generates a control request command 402 to be incorporated into the frame 2 according to the received control command sending request, and further incorporates the address of the portal server 80 into such control request command 402. The control request unit 13 generates a frame 2 and passes it to the encryption processing unit. In a

manner equivalent to the first, second and third embodiments, an encryption processing unit 12 encrypts the frame 2, and a communication unit 14 generates a packet 3 and sends it to a router 4.

[0048]

In a manner equivalent to the first, second and third embodiments, a communication unit 60 of an internet terminal 6 receives a packet 4, and an encryption processing unit 62 decrypts a data part 414 of the packet 4 and passes the resultant to a control unit 63. The control unit 63 obtains the control request command 402 included in the data part 414 of the packet 4, and controls the internet terminal 6 or an appliance 7 according to the contents of the control of the control request command 402.

[0049]

An appliance control unit 70 of the appliance 7 sends data indicating the control result to the internet terminal 6.

[0050]

The control unit 63 of the internet terminal 6 incorporates, into a frame 3, the data indicating the control result sent by the appliance 7 or the control result of the internet terminal 6, and passes it to an encryption processing unit 62. The encryption processing unit 62 encrypts the frame 3, and passes the resultant to the communication processing unit 60. The communication unit 60 generates a packet (to be referred to as "packet 7" hereafter) to be sent to the portal server 80 and sends it to the router 4.

[0051]

The router 4, in a manner equivalent to the first embodiment, converts the received packet 7 into a packet (to be referred to as "packet 8" hereinafter) to be sent to the portal server 80, and sends the resultant to the portal server 80 via the internet network 2.

[0052]

The communication unit 81 of the portal server 80 receives the packet 8 and passes it to an encryption processing unit 82, which then decrypts the frame 3 and passes the resultant to a request processing unit 83. Subsequently, the request processing unit 83 obtains the data indicating the control result of either the appliance 7 or the internet terminal 6 included in the frame 3 and passes it to a communication unit 81, and the communication unit 81 sends the received control result of either the appliance 7 or the internet terminal 6 to the mobile terminal 9.

[0053]

Note that, in the explanation of the present invention, the adjustment of the polling interval 1 does not necessarily have to be shortened by the minute, and therefore that it may vary depending on the implementation.

[0054]

[Effects of the Invention]

As described above, in an environment where a router is connected to an internet network at all times, the present invention allows an immediate control of an internet terminal placed inside a house by an internet server even when the polling method is used.

[Brief Description of Drawings]

[FIG. 1]

A diagram showing a configuration of a communication system according to the first embodiment of the present invention.

[FIG. 2]

A flowchart showing a procedure followed by an internet terminal according to the first embodiment of the present invention when sending a local packet to a router periodically.

[FIG. 3]

A diagram showing a data structure of a packet sent by the internet terminal according to the first embodiment of the present invention.

[FIG. 4]

A diagram showing a data structure of table information held by the router according to the first embodiment of the present invention.

[FIG. 5]

A flow chart showing a procedure followed by an internet server according to the first embodiment of the present invention when receiving a global packet and sending a response global packet.

[FIG. 6]

A diagram showing a data structure of terminal information held by the internet server according to the first embodiment of the present invention.

[FIG. 7]

A diagram showing a data structure of the response global packet sent by the internet server according to the first embodiment of the present invention.

[FIG. 8]

A flowchart showing a procedure followed by the internet server according to the first embodiment of the present invention when receiving a response local packet.

[FIG. 9]

A diagram showing a configuration of a communication system according to the second embodiment of the present invention.

[FIG. 10]

A diagram showing a configuration of a communication system according to the third embodiment of the present invention.

[FIG. 11]

A diagram showing a configuration of a communication system according to the fourth embodiment of the present invention.

[Numerical References]

1 Internet server

2 Internet network

3 Communication line

4 Router

5 Private network
6 Internet terminal
7 Appliance
8 Home network
9 Mobile terminal
10 Terminal information storage unit
11 Response interval adjustment unit
12 Encryption processing unit of the internet server 1
13 Control request unit
14 Communication unit of the internet server 1
60 Communication unit of the internet terminal 6
61 Polling unit
62 Encryption processing unit of the internet terminal 6
63 Control unit
64 Polling interval adjustment unit
70 Appliance control unit
80 Portal server
81 Communication unit of the portal server 80
82 Encryption processing unit of the portal server 80
83 Request processing unit

[Document] Abstract of the Disclosure

[Abstract]

[Object]

In an environment where an internet terminal is connected to an internet network via a router at all times, such conventional problems have existed that, when an internet server controls the internet terminal, immediacy is lost, or time-consuming setting of the router is required.

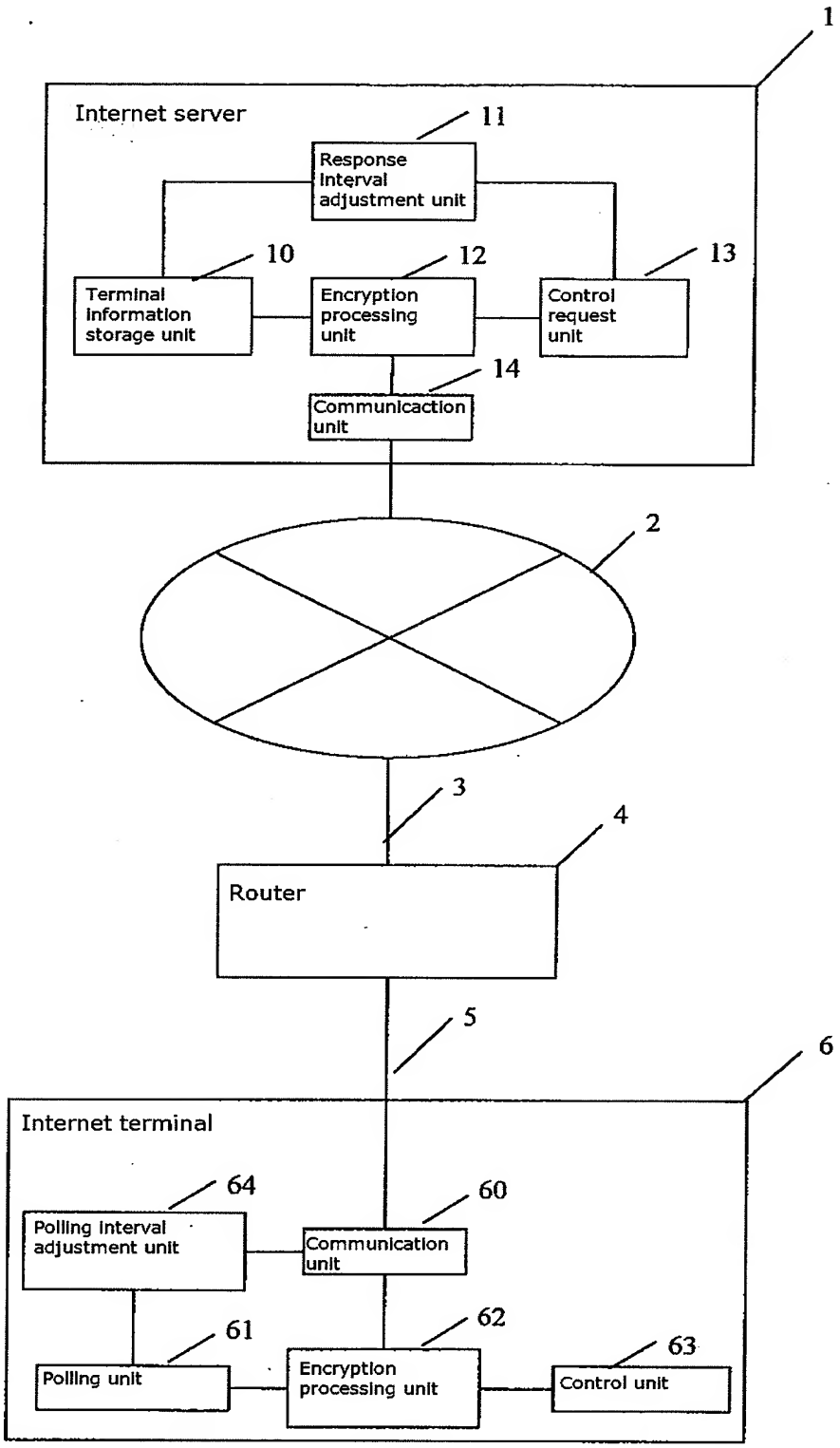
[Means to Achieve the Object]

The present invention allows an internet terminal to be controlled by the following procedures: the internet terminal periodically sends a packet to be sent to an internet server; the internet server stores terminal information included in the received packet, and generates and sends a response packet to be sent to the internet terminal from the terminal information when a control request to the internet terminal occurs; and the internet terminal receives the response packet.

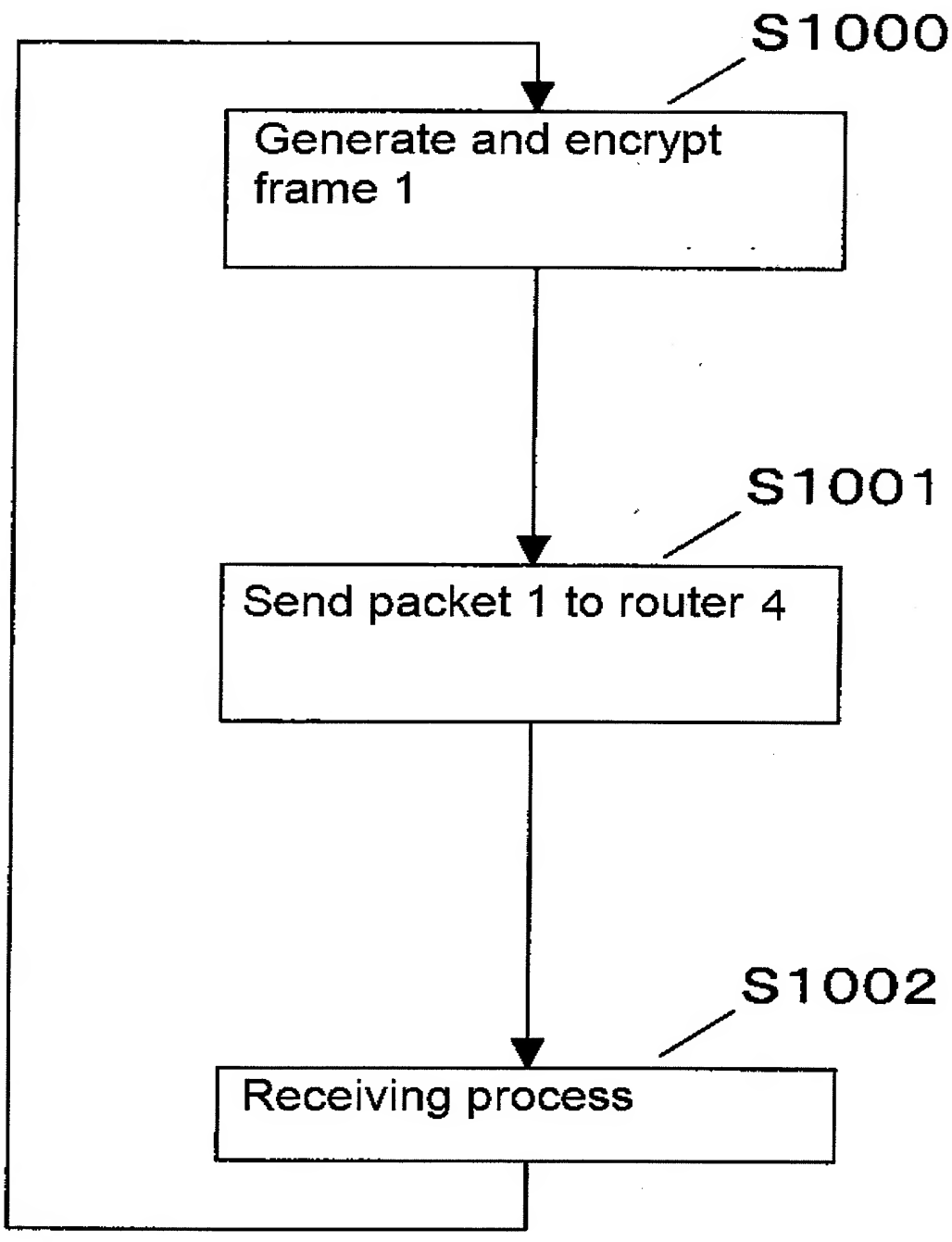
[Selected Drawing] FIG. 1

[Document] Drawings

[FIG. 1]

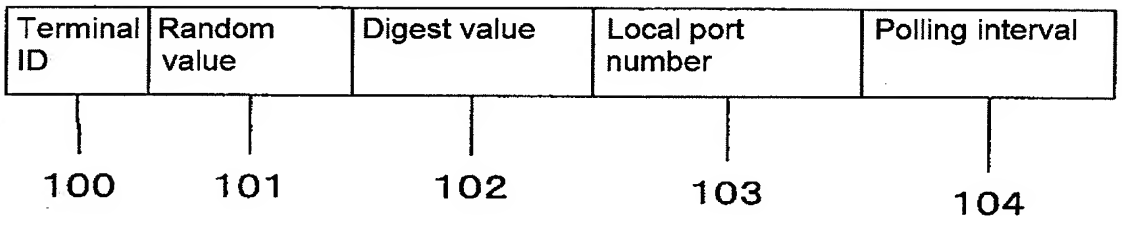


[Fig. 2]

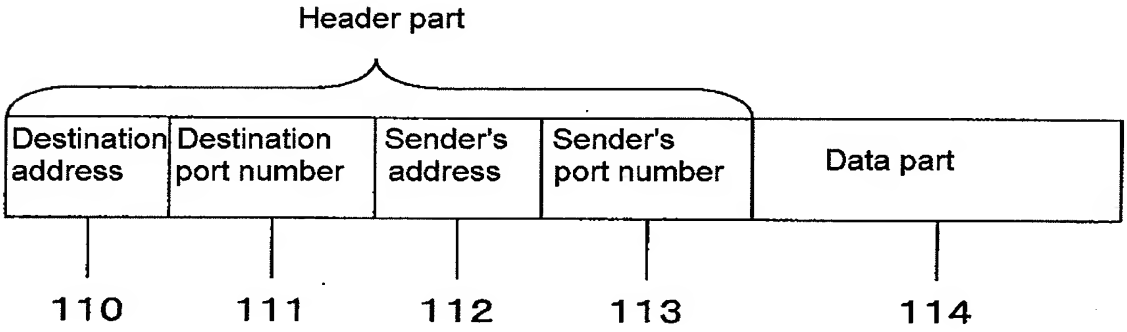

S1000
Generate and encrypt frame 1
S1001
Send packet 1 to router 4
S1002
Receiving process

[FIG. 3]

(a)



(b)

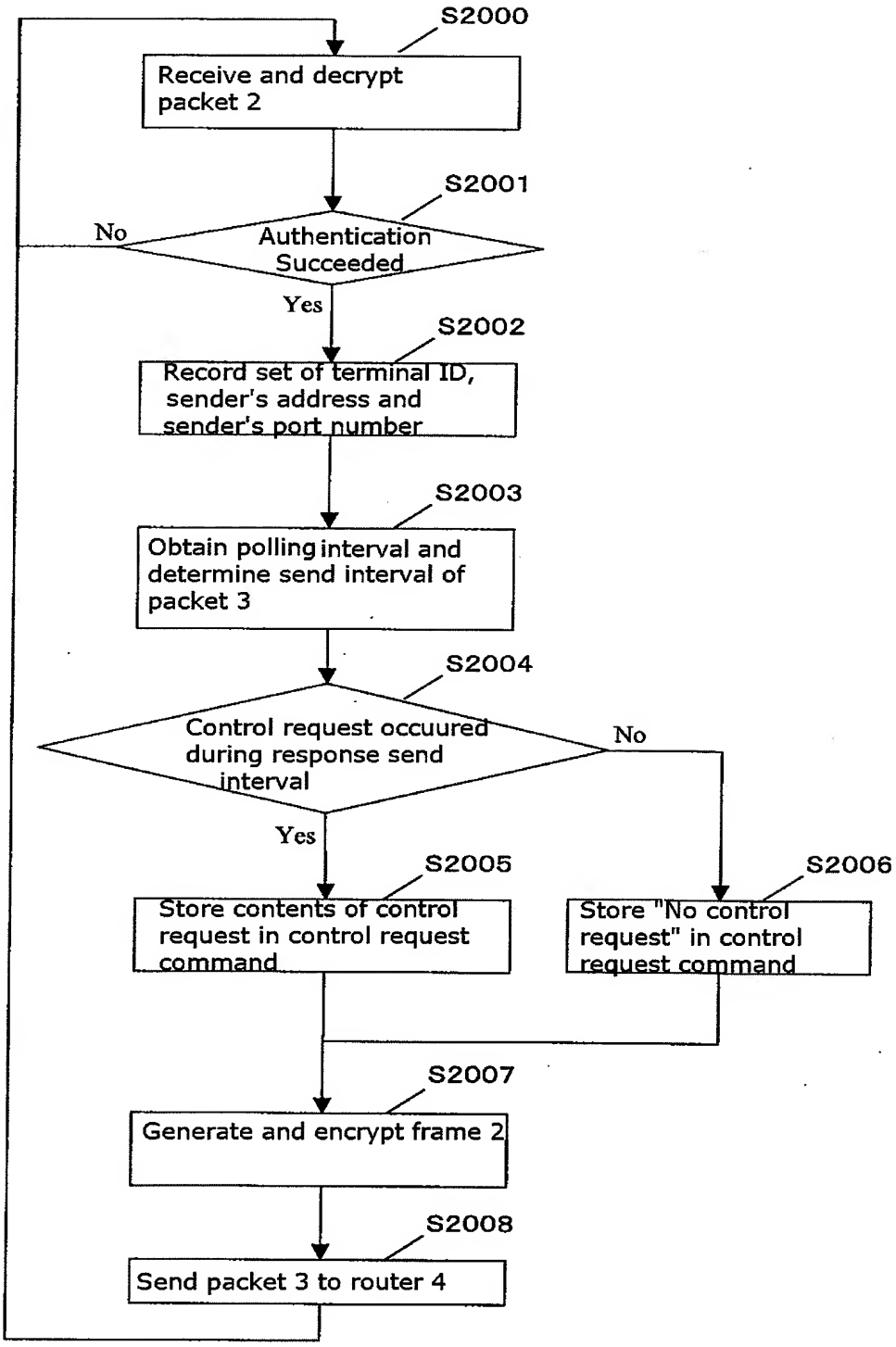


[FIG. 4]

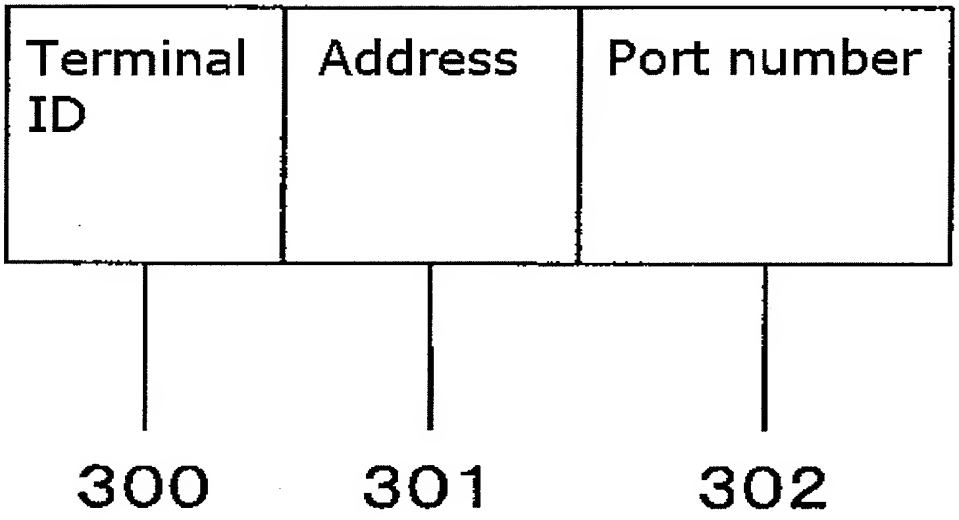
Internet terminal 6		Router 4	
Address	Port number	Address	Port number
192.168.0.2	5000	200.123.4.5	6000

200 201 202 203

[FIG. 5]

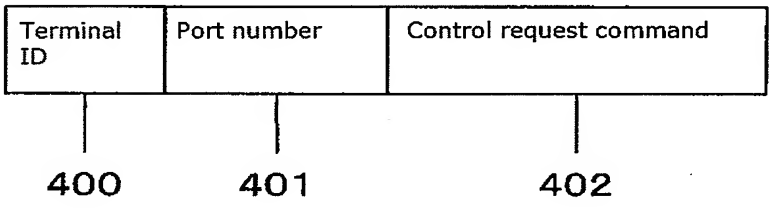

S2000
Receive and decrypt packet 2
S2001
No
Authentication Succeeded
Yes
S2002
Record set of terminal ID, sender's address and sender's port number
S2003
Obtain polling interval and determine send interval of packet 3
S2004
Control request occuured during response send interval
No
Yes
S2005
Store contents of control request in control request command
S2006
Store "No control request" in control request command
S2007
Generate and encrypt frame 2
S2008
Send packet 3 to router 4

[FIG. 6]

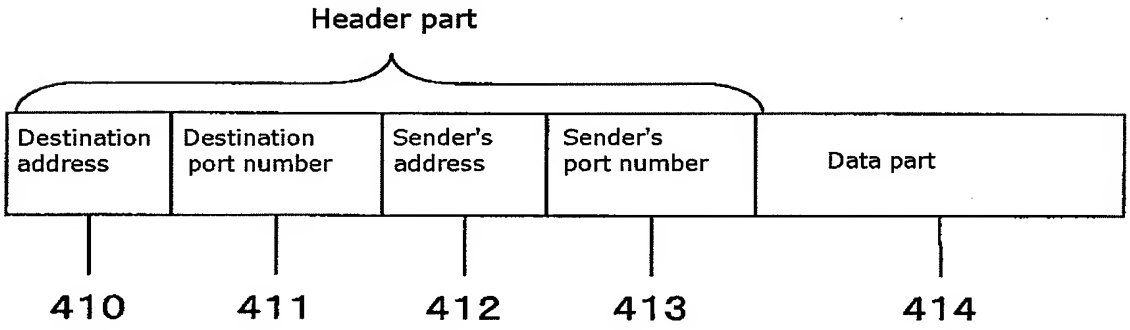

Terminal ID
Address
Port number
300
301
302

[FIG. 7]

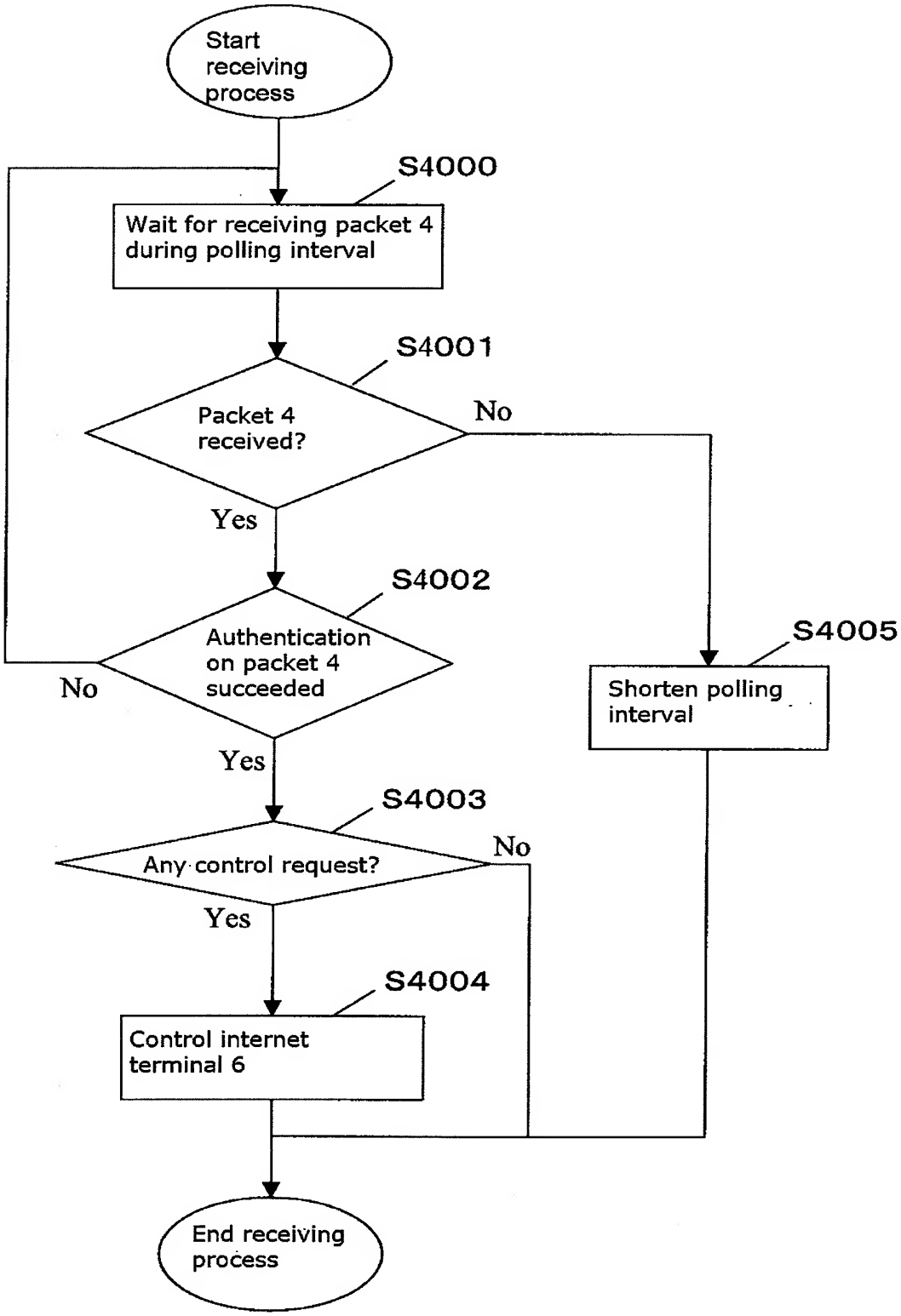
(a)


Terminal ID
Port number
Control request command
400
401
402

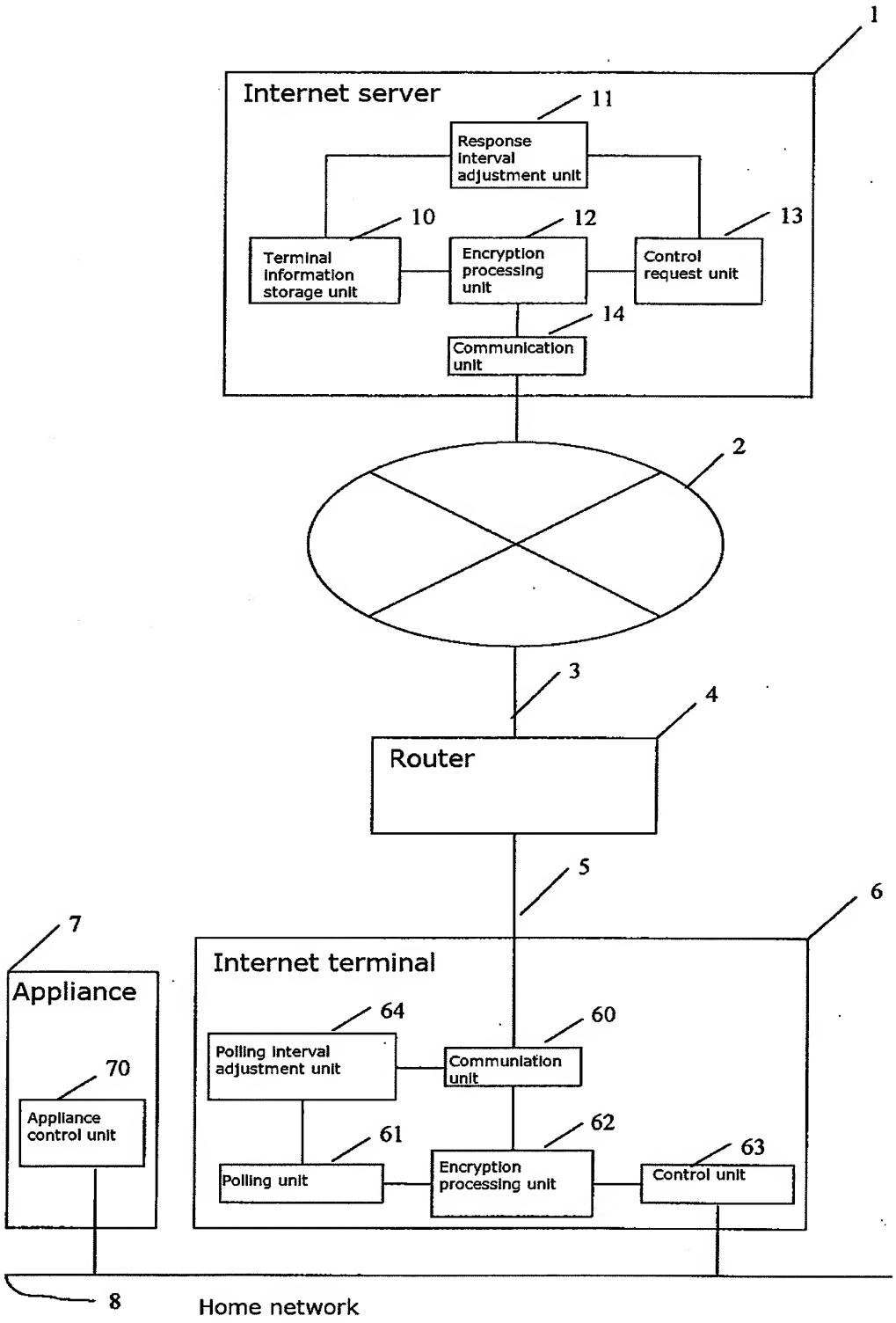
(b)


Header part
Destination address
Destination port number
Sender's address
Sender's port number
Data part
410
411
412
413
414

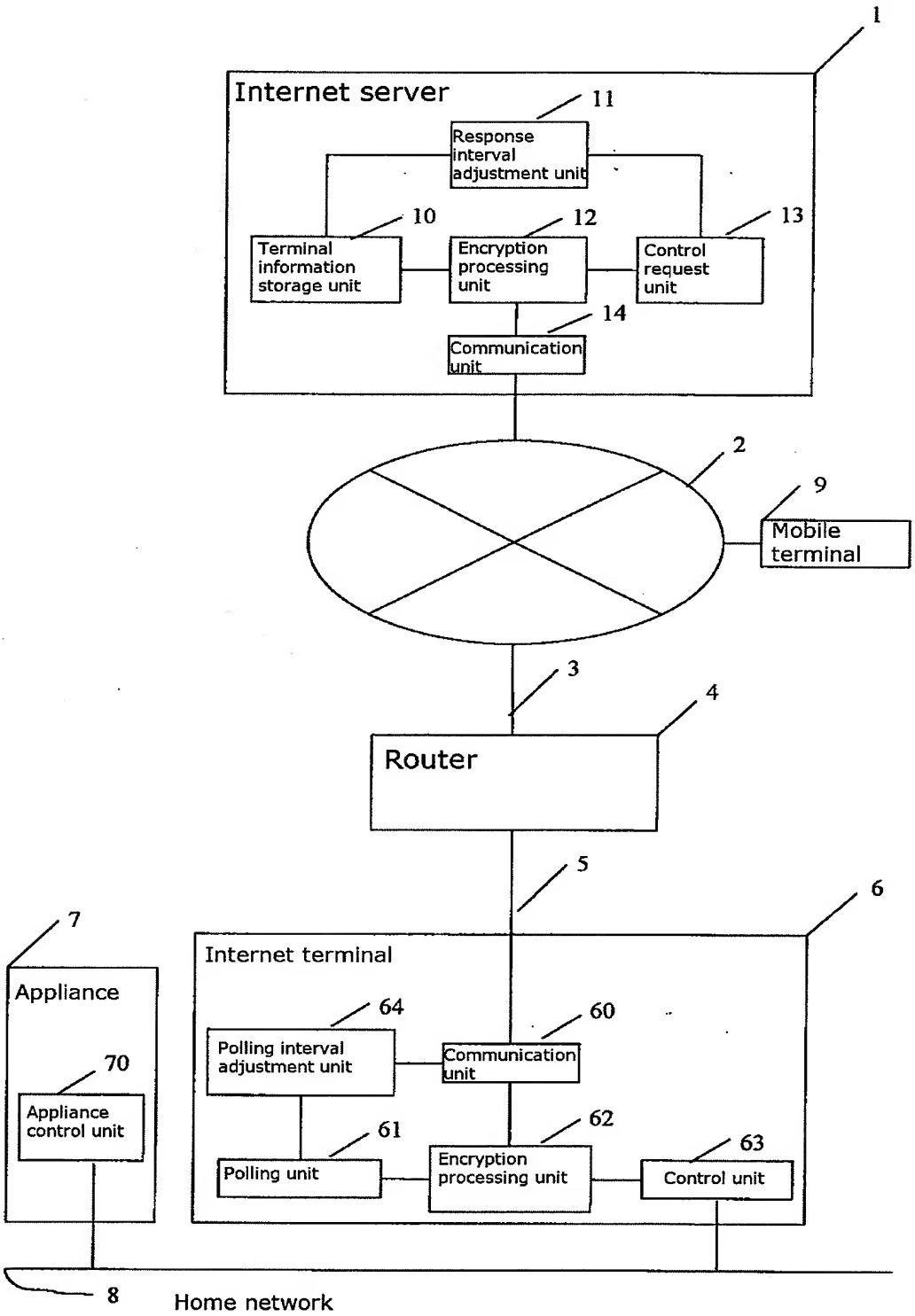
[FIG. 8]


Start receiving process
S4000
Wait for receiving packet 4 during polling interval
S4001
Packet 4 received?
No
Yes
S4002
Authentication on packet 4 succeeded
No
Yes
S4005
Shorten polling interval
S4003
Any control request?
No
Yes
S4004
Control internet terminal 6
End receiving process

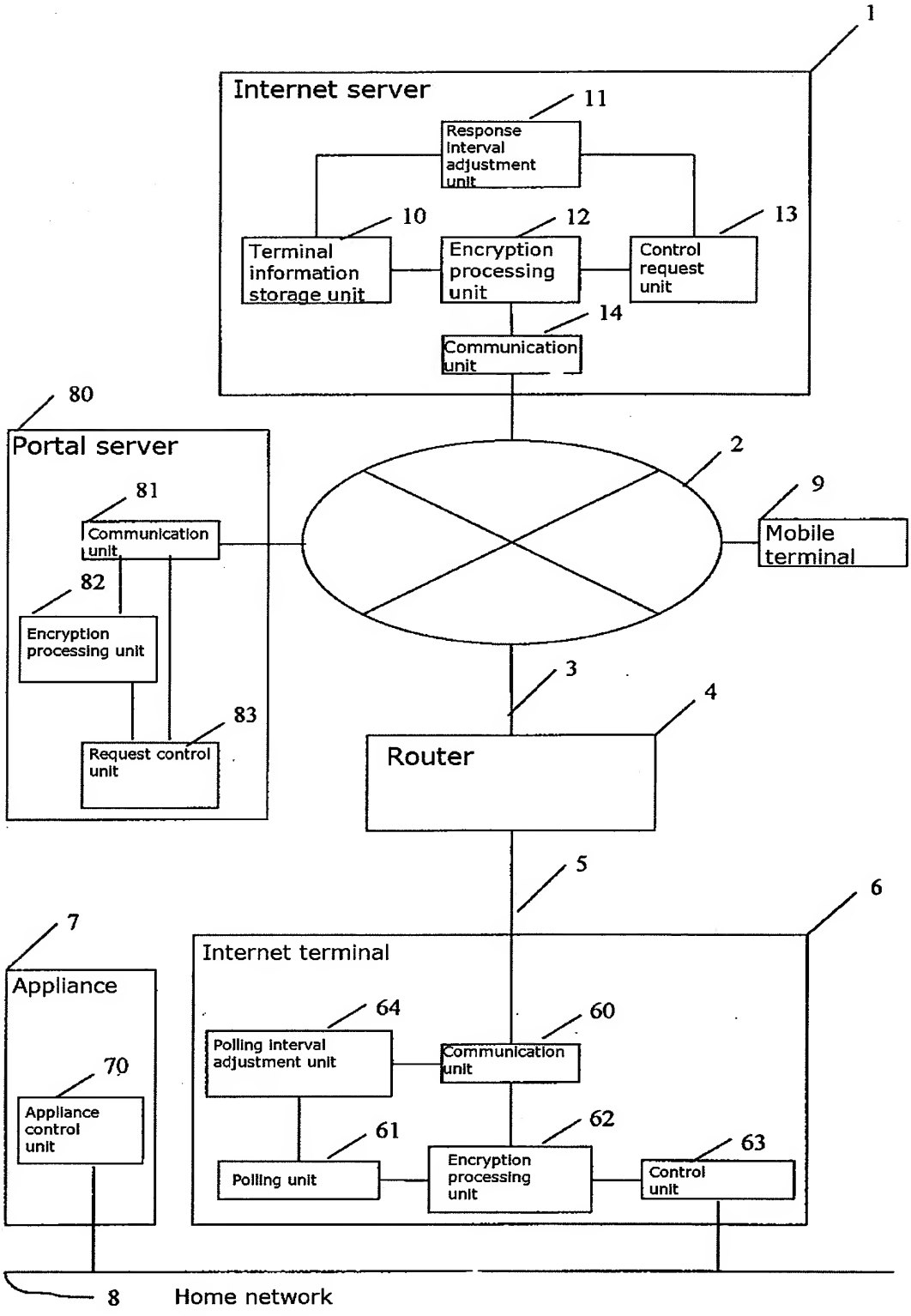
[FIG. 9]


1
Internet server
11
Response interval adjustment unit
10
12
13
Terminal information storage unit
Encryption processing unit
Control request unit
14
Communication unit
2
3
4
Router
5
6
7
Appliance
Internet terminal
64
60
70
Polling interval adjustment unit
Communiation unit
Appliance control unit
61
62
63
Polling unit
Encryption processing unit
Control unit
8
Home network

[FIG. 10]


1
Internet server
11
Response interval adjustment unit
10
Terminal information storage unit
12
Encryption processing unit
13
Control request unit
14
Communication unit
2
9
Mobile terminal
3
4
Router
5
6
7
Appliance
70
Appliance control unit
Internet terminal
64
Polling interval adjustment unit
60
Communication unit
61
Polling unit
62
Encryption processing unit
63
Control unit
8
Home network

[FIG. 11]


1
Internet server
11
Response interval adjustment unit
10
Terminal information storage unit
12
Encryption processing unit
13
Control request unit
14
Communication unit
80
Portal server
81
Communication unit
82
Encryption processing unit
83
Request control unit
2
9
Mobile terminal
3
4
Router
5
6
7
Appliance
70
Appliance control unit
Internet terminal
64
Polling interval adjustment unit
60
Communication unit
61
Polling unit
62
Encryption processing unit
63
Control unit
8
Home network